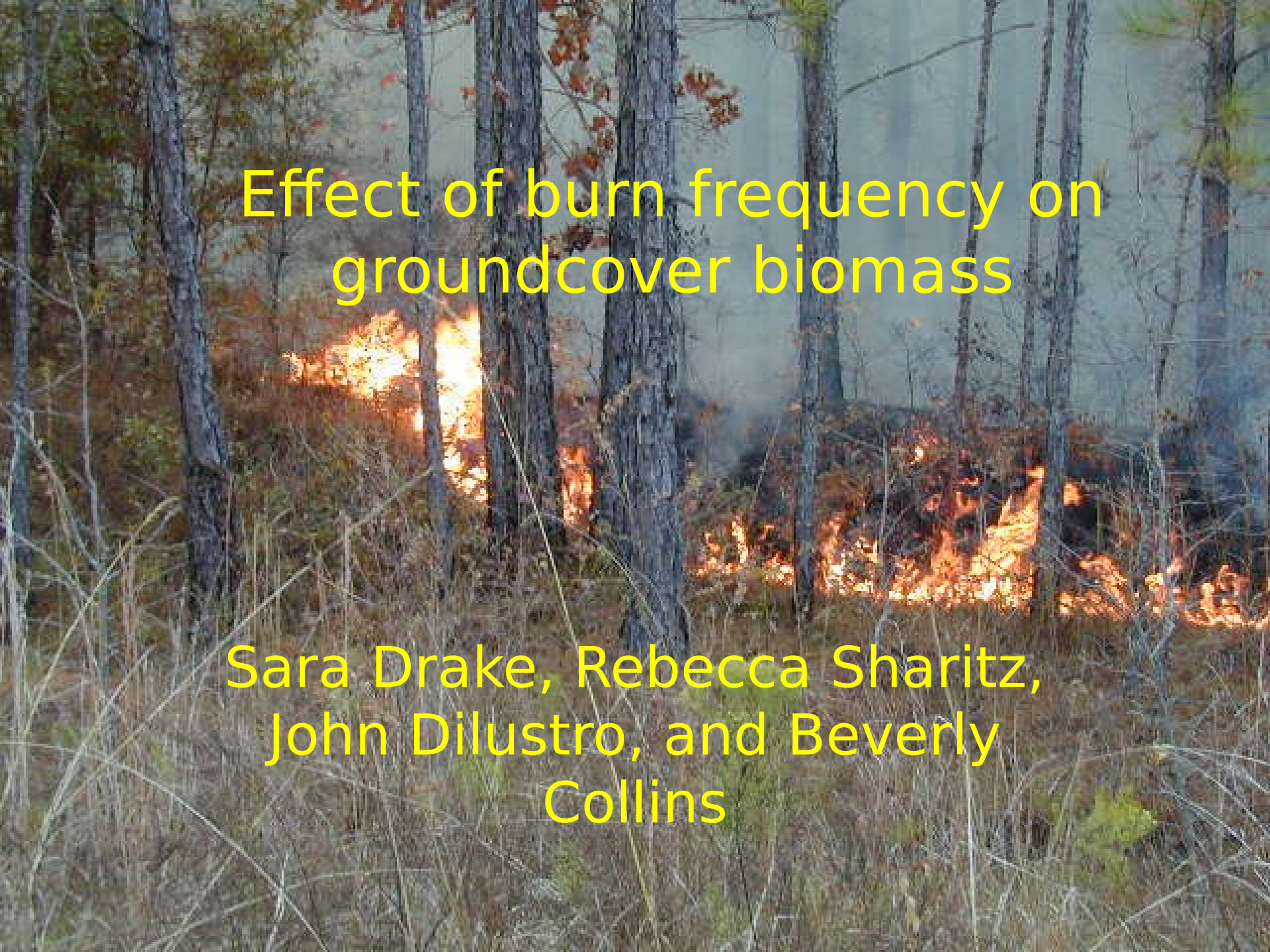


Effect of burn frequency on groundcover biomass

Sara Drake, Rebecca Sharitz, John Dilustro, and Beverly Collins

Objectives

- Study effects of disturbance due to burning and military use
- Study effects of burn frequency and soil texture on productivity and N_2-fixation
- Develop Stella N model

Fire and Soil Texture

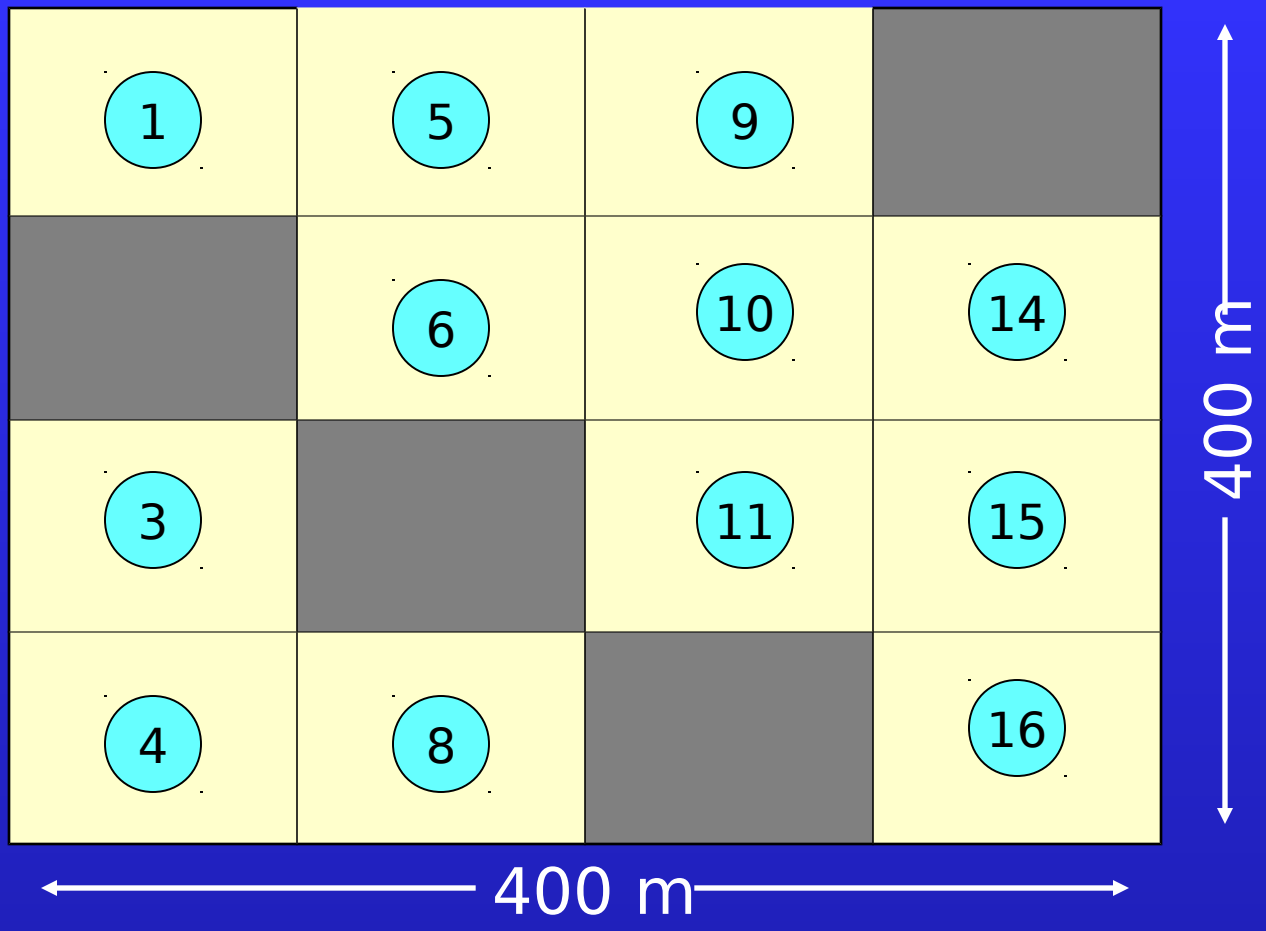
- Necessary for pine overstory
- High species diversity
- Little known about natural fire regime
- Influence of soil texture on vegetation patterns

Why study productivity?

- Fundamental ecosystem measure
- Primary force driving ecosystem function
  - Consumers
  - Nutrient and water cycles
- ANPP equivalent to peak above- and belowground biomass

Questions

- How do different burn frequencies affect above- and belowground productivity?
- What effect does underlying soil texture have on above- and belowground productivity?
- How do different plant groups (i.e. legumes, grasses, etc.) respond to varying burn frequencies and underlying soil textures?

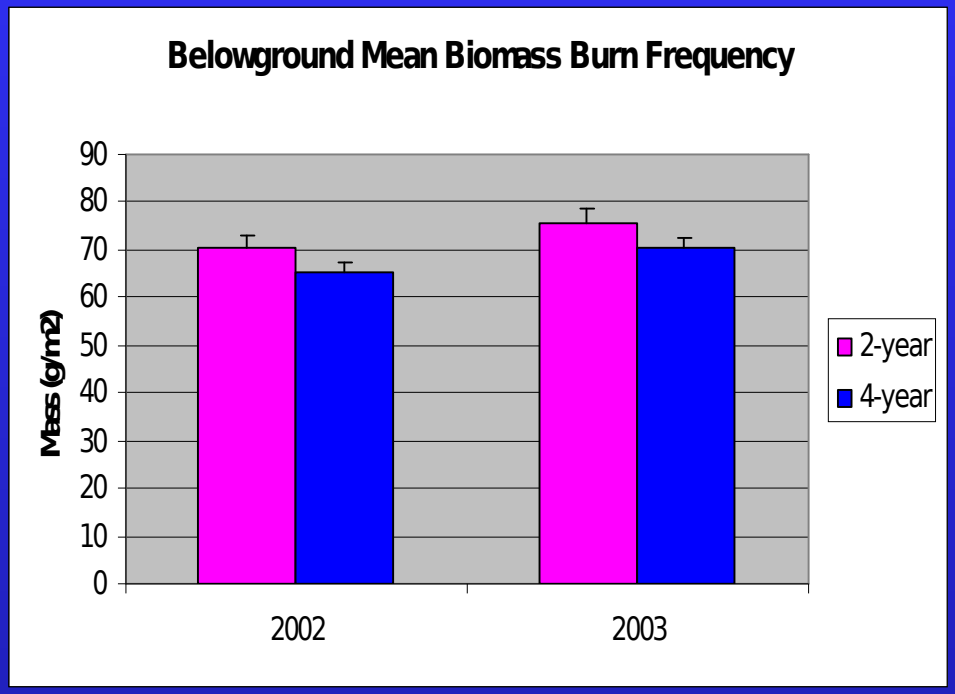


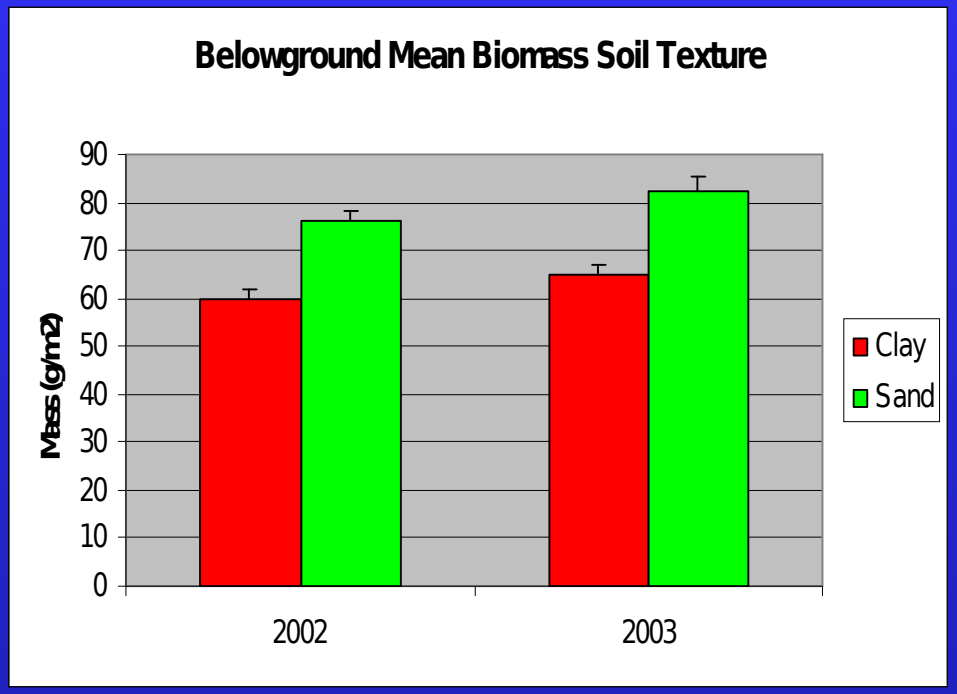
Site Layout

Experimental design

	2-year burn	4-year burn
Clay	4 sites	4 sites
Sand	4 sites	4 sites

Belowground Biomass





2-way ANOVA

(2002) P = 0.1086

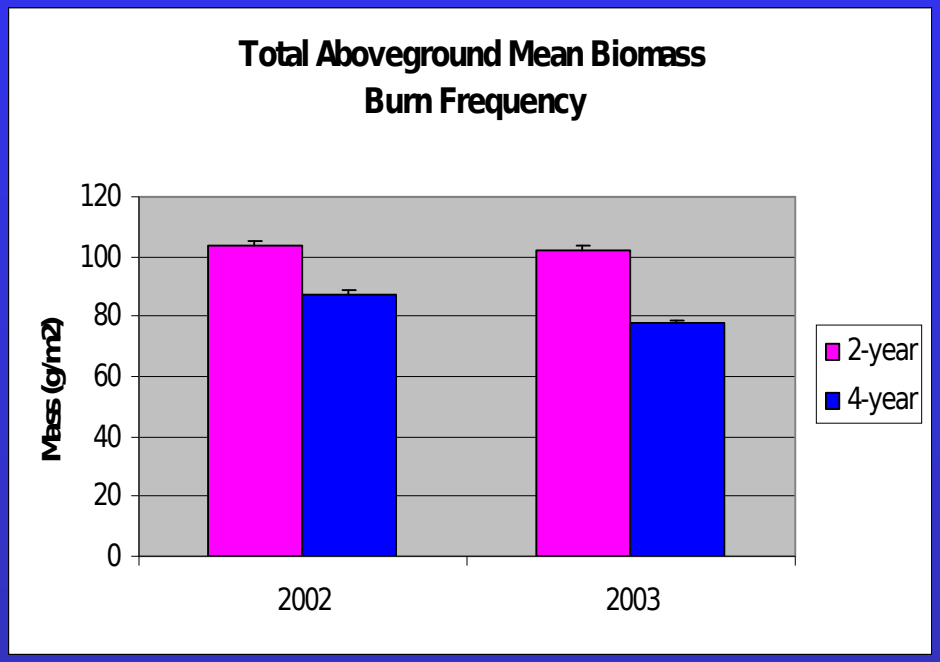
(2003) P = 0.0679

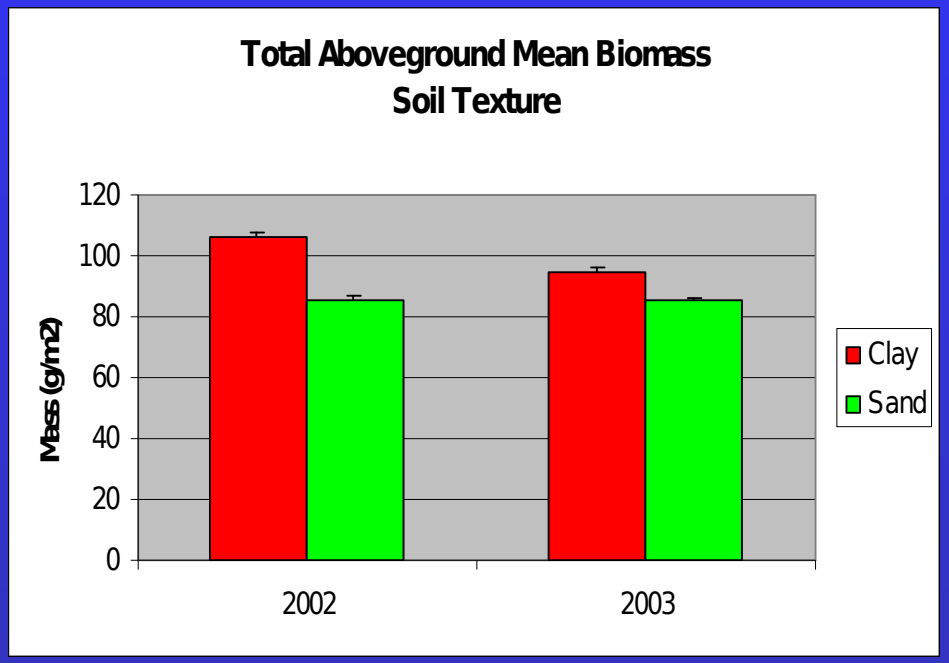
2-way ANOVA

*(2002) P < 0.0001

*(2003) P < 0.0001

Aboveground Biomass





2-way ANOVA

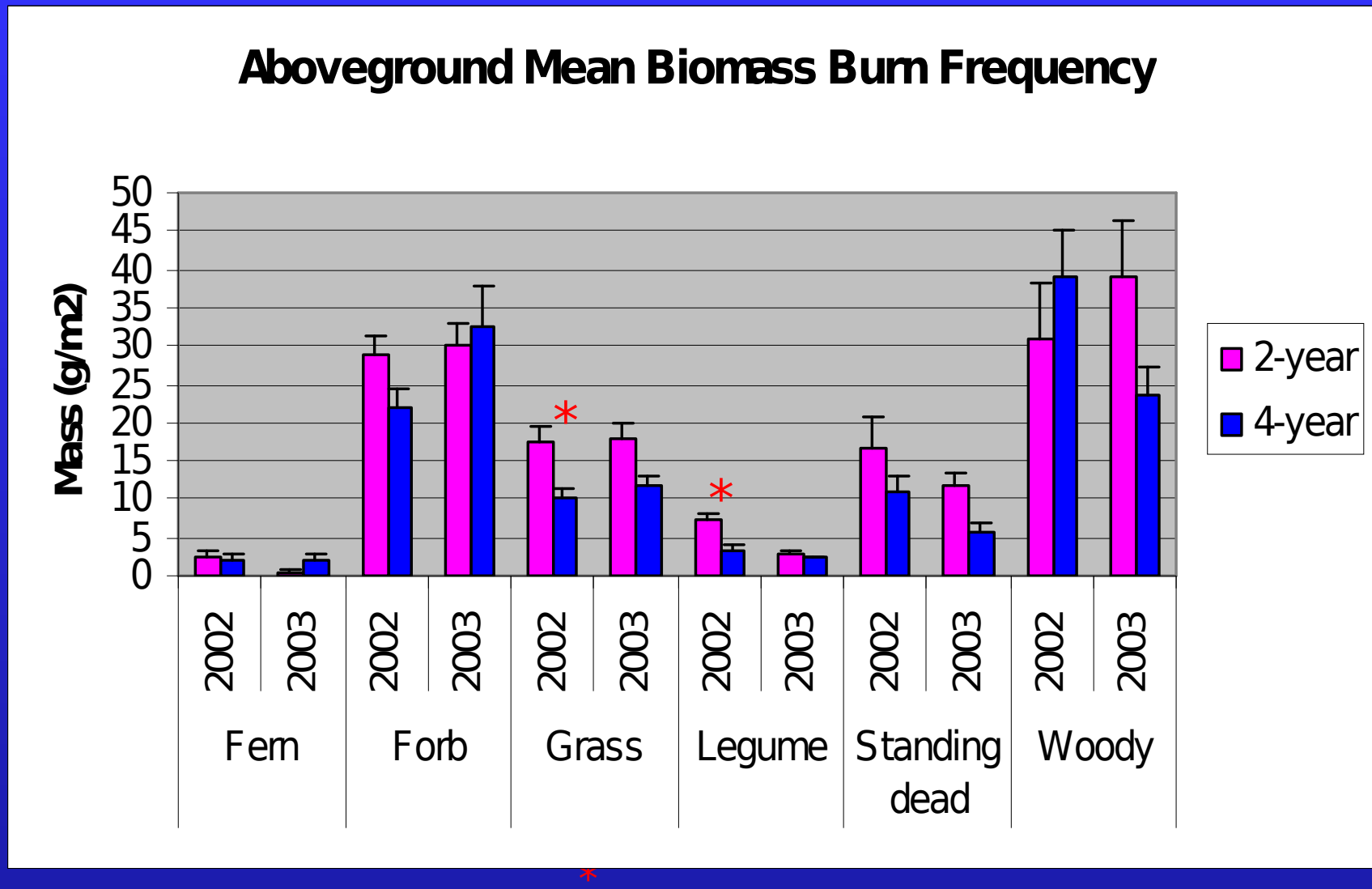
(2002) P = 0.1384

(2003) P = 0.0557

2-way ANOVA

(2002) P = 0.0564

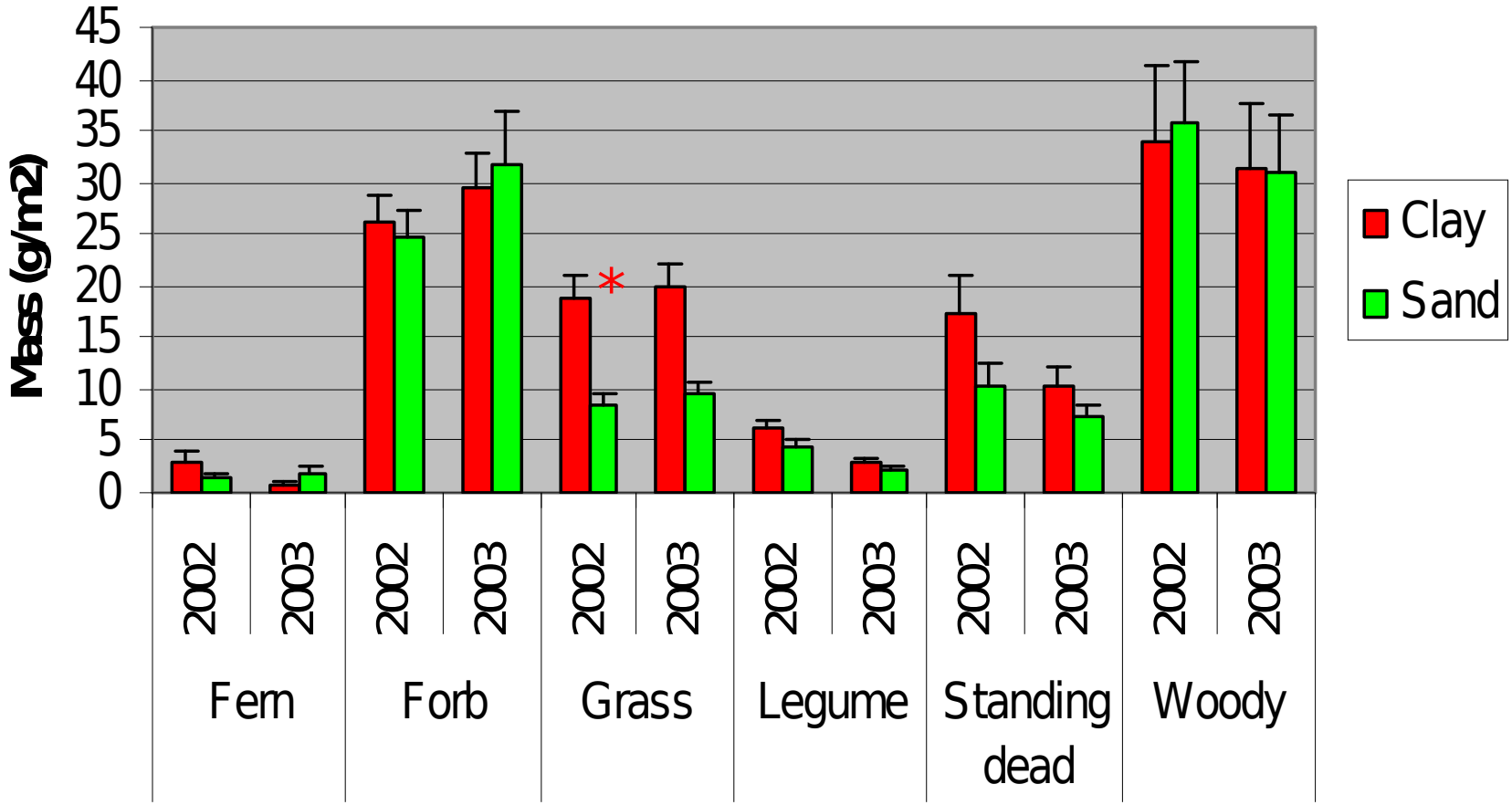
(2003) P = 0.9752



*Grass (2002) p = 0.0038

* Legume (2002) p = 0.0012

Aboveground Mean Biomass Soil Texture



Grass (2002) $p<0.001$

Summary and Conclusions
Belowground Productivity

- Significantly greater biomass on sandy sites 2002 and 2003
  - May be response to water stress (Abrahamson and Hershey 1977)
  - Low aboveground biomass in sandy sites may be offset by greater belowground biomass

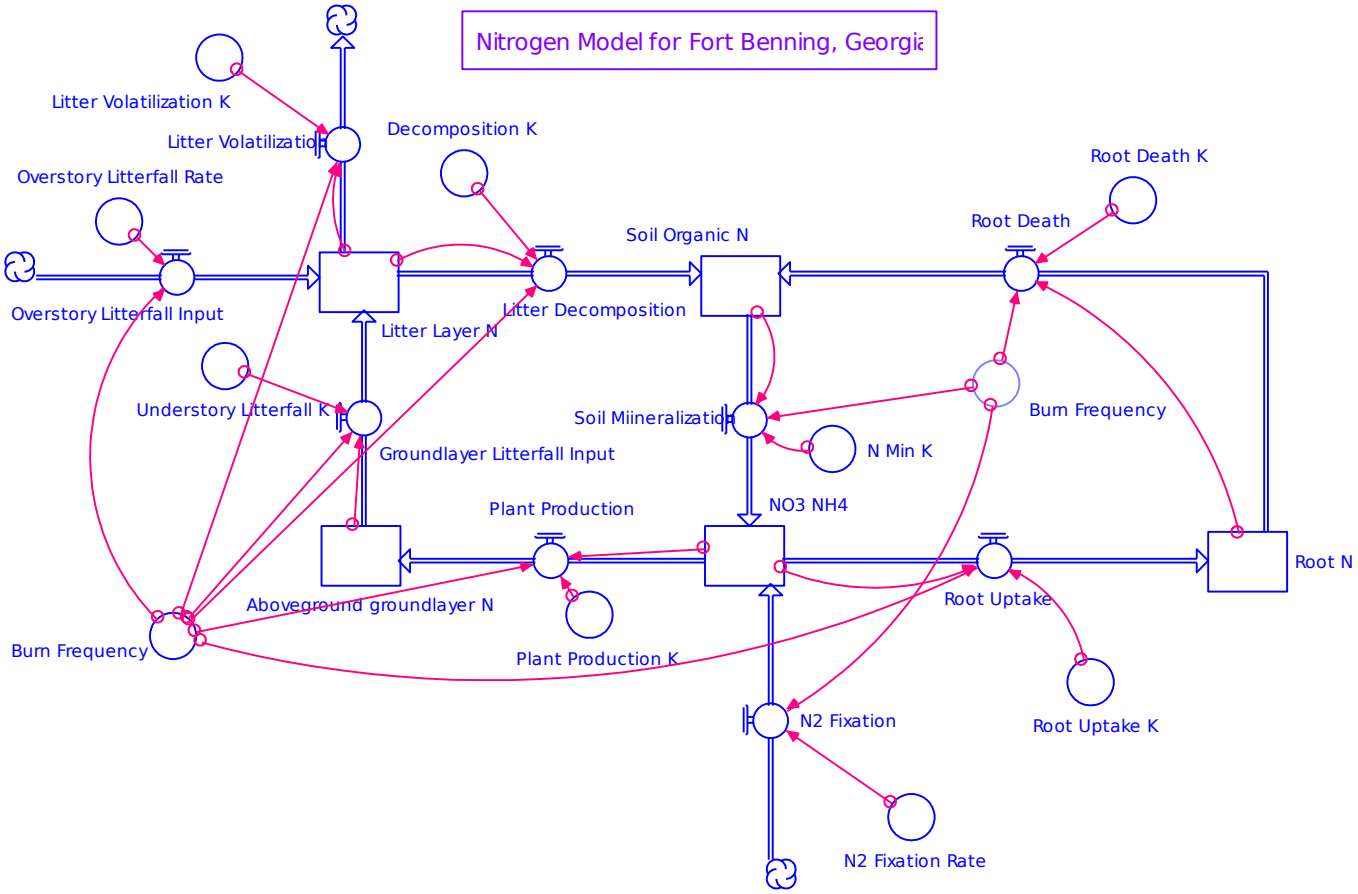
Summary and Conclusions
Aboveground Productivity

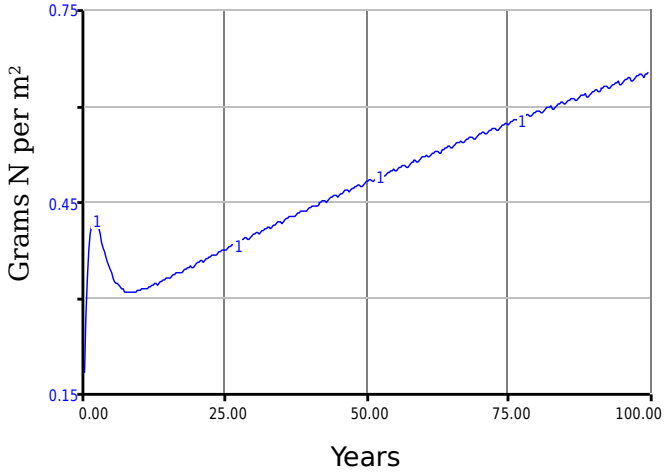
- Greater biomass on 2-year burn sites 2002 and 2003
  - ANPP increases with increasing burn frequency (Raison 1979)
  - Pulse of nutrients after fire (Neary et al. 1999)
- Greater biomass on clayey sites 2002 and 2003
  - Availability of soil moisture (Kirkman et al. 2001)
- Grasses and legumes significantly greater biomass on 2-year burn sites 2002
  - Grasses are rhizomatous and re-sprout from surviving meristems
  - Legumes are N_2-fixers
- Grasses significantly greater on clayey sites 2002

N_2-Fixation - Acetylene Reduction Assay How do N_2-fixation rates vary across treatments?

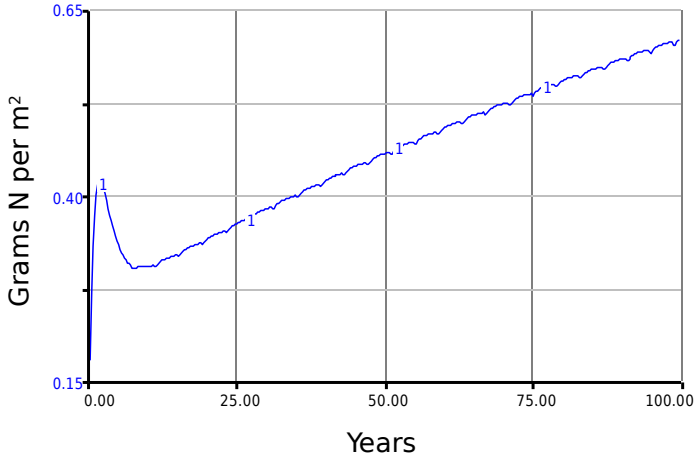
- N_2-fixation by enhanced legume populations may replenish or exceed the nitrogen lost due to burning (Hendricks and Boring 1999).
- Nitrogenase converts acetylene to ethylene.
- GC measures amount of both gases in a sample
  - an indirect measure of N_2-fixation.

Stella Model

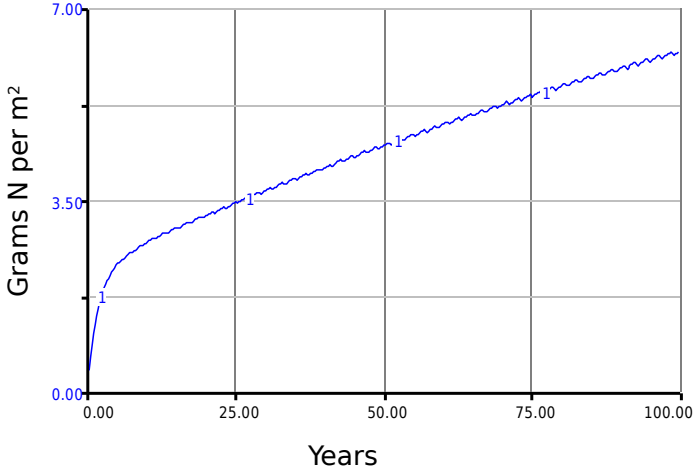




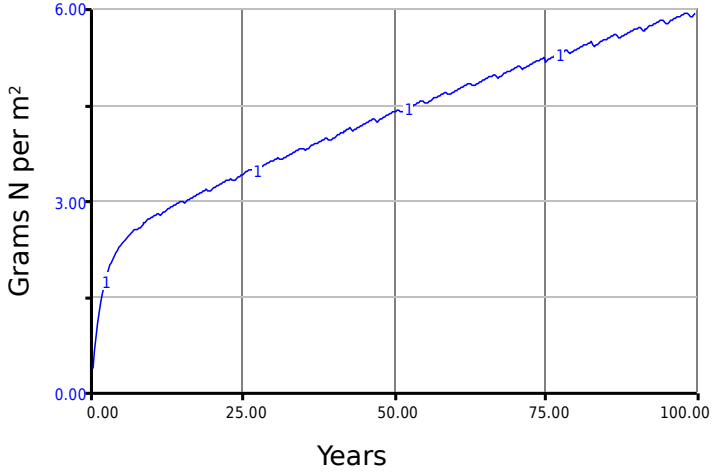
Aboveground groundlayer N with 2-year burn. Aboveground groundlayer N increases from 0.17 g/m² to 0.65 g/m².



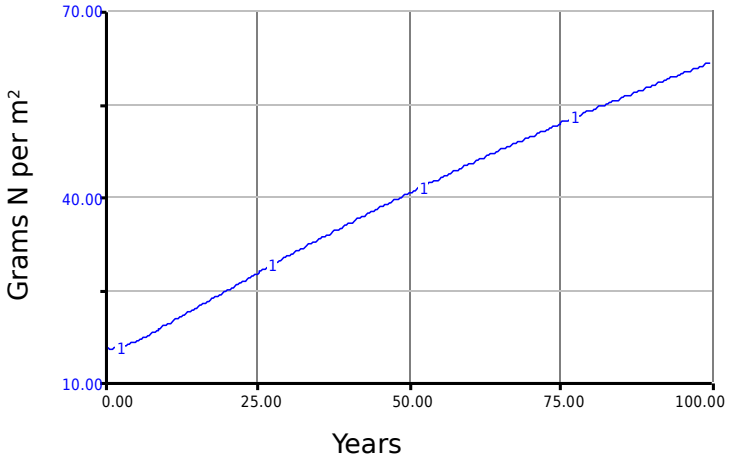
Aboveground groundlayer N with 4-year burn. Aboveground groundlayer N increases from 0.17 g/m² to 0.61 g/m².



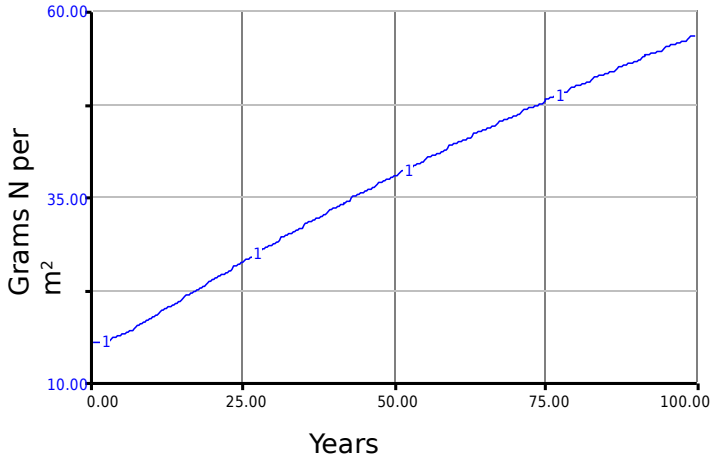
Root N with 2-year burn. Root N increases from 0.33 g/m² to 6.91 g/m².



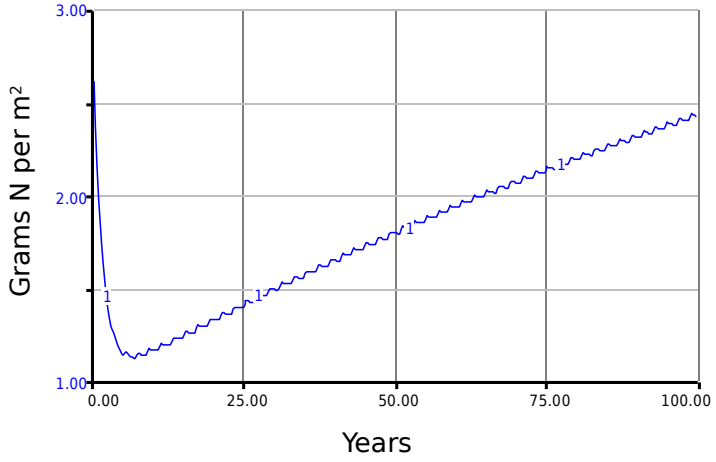
Root N with 4-year burn. Root N increases from 0.33 g/m² to 5.91 g/m².



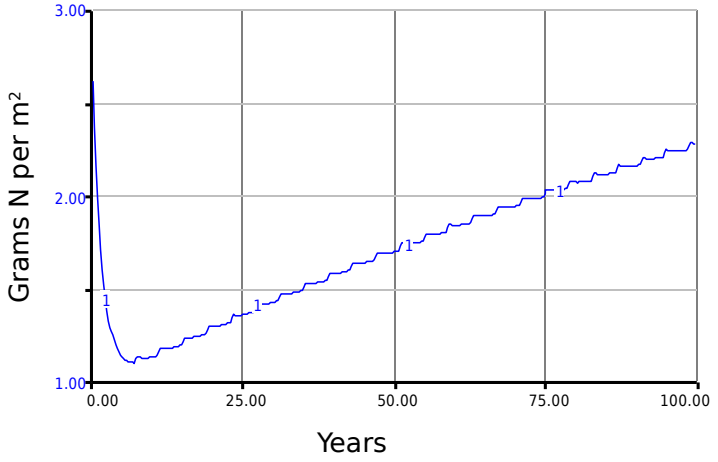
Soil organic N with 2-year burn. Soil organic N goes from 15 g/m² to 61 g/m².



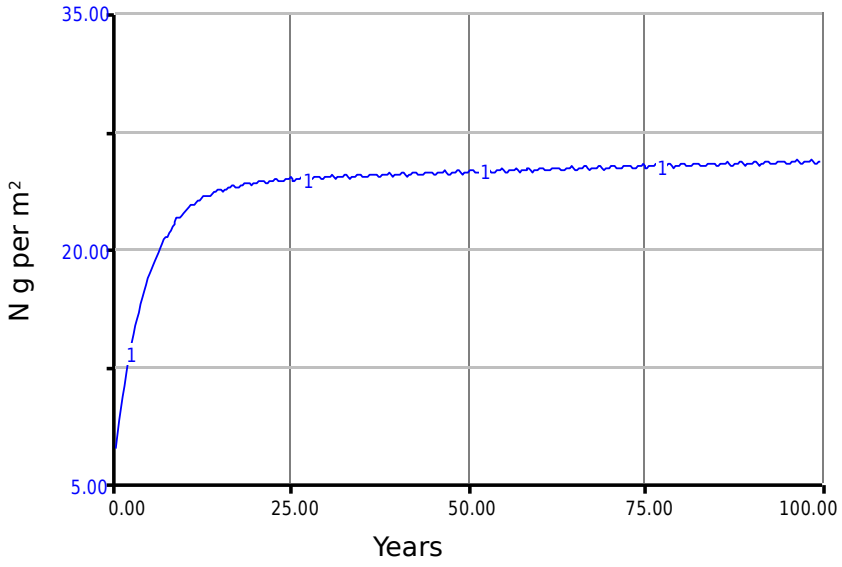
Soil organic N with 4-year burn. Soil organic N increases from 15 m² to 56 g/m².



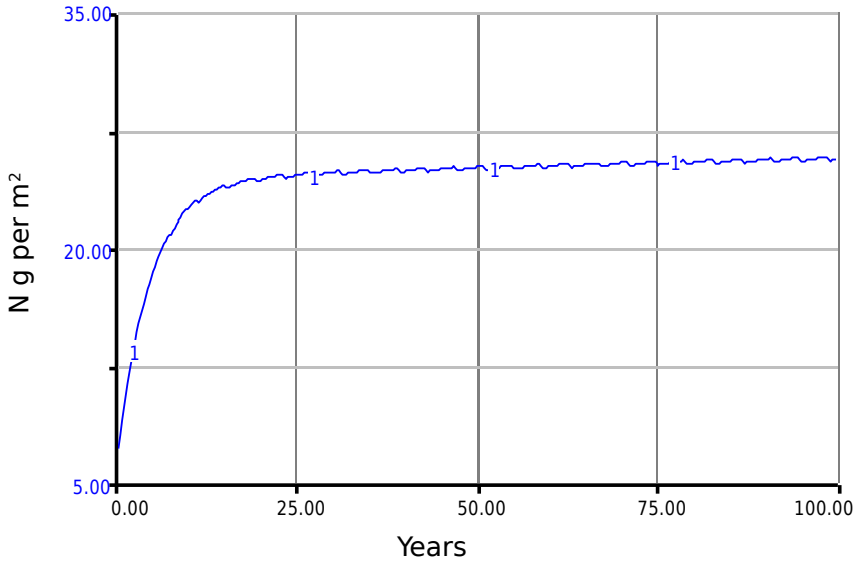
Plant available N (NO_3^- and NH_4^+) with 2-year burn. Plant available N starts at 2.61 g/m², declines rapidly in the first 6 years and then increases slowly to 2.42 g/m².



Plant available N (NO_3^- and NH_4^+) with 4-year burn. Plant available N starts at 2.61 g/m², declines rapidly in the first 6 years and then increases slowly to 2.27 g/m².



Litter layer N with 2-year burn. Litter N increases from 7 g/m² to about 25 g/m² by year 10 and then levels off.



Litter Layer N with 4-year burn. Litter N increases from 7 g/m² to 26 g/m² by year 10 and then levels off.

Acknowledgements

- Fort Benning Team:
  - Adam Boretsky
  - Lisa Duncan
  - Tonya Euell
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